July 19, 1949

Professor Joshua Lederberg
Department of Genetics
The University of Wisconsin
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Madison 6, Wisconsin

Dear Professor Lederberg,

I want to thank you for your interest in my work and to apologize for my delay in replying, occasioned by a modest post-doctoral vacation. I shall be glad to give what assistance I can to your projected studies of "specific adsorption". Unfortunately, the publication which you accurately describe as "sketchy" is nonetheless a pretty fair summary of the information currently at hand. These experiments were carried out with the sole objective of demonstrating that the underlying idea is sound. A broad investigation of the phenomenon has been started this summer in our laboratories.

The following supplementary details of the procedure might help you to repeat the experiments and answer your specific questions. The sodium silicate solution diluted to a volume of 150 ml. was placed in a 600 ml. beaker. The dye, acid, and the remainder of the water were mixed separately and added, all at once, with vigorous stirring. The beaker was covered with a watch glass and allowed to stand for 8 days. At the end of this time the firm gel was expelled onto paper towels, chopped up with a spatula, and allowed to dry for 6 days longer when it had become quite brittle and weighed in the neighborhood of 30 g. After grinding, sieving, and extracting with methanol the weight was reduced to 10--11 g.

In measuring the adsorption I have always first equilibrated the gel sample with the solvent alone in order to avoid the possibility that the adsorbents would alter the pH of the dye solutions or produce some other random effect. This has been done by shaking the gel sample with 3 successive 10 ml. portions of solvent over a period of 2 or 3 hours. The sample, contained in a glass stoppered cylinder, was then mixed with such a volume of solvent as to make the weight 9 g. greater than the weight of the cylinder plus dry gel alone. A 1 g. portion of a 1.50×10^{-4} formal solution of the dye was then added to give the described system.

Equilibrium is very closely approached on shaking for just a few minutes. However, the specific adsorbents take up an appreciably greater amount of dye over a period of hours and the published results were obtained by shaking mechanically for 30 minutes, allowing to stand for 24 hours and again shaking for 30 minutes.

Cloudiness was minimized by centrifuging the supernatant solutions. Readings in a Beckman spectrophotometer were taken at 5100 Å (maximum for the dyes in 5% acetic acid) and were corrected by subtracting 1.46 x the extinction reading at 6000 Å. At 6000 Å the light absorption by the dyes is negligible. The factor, 1.46, is empirical and approximate.

I can not be very positive about the reproducibility of the magnitudes of the specific effects. Most of our experiments were done with methyl orange and the "relative adsorption powers" have ranged from 2.5 to 5.5. Small differences in the conditions of preparation may greatly influence the characteristics of the adsorbents and for this reason it is important to prepare a control gel at the same time and in exactly the same way as

the specific adsorbents. If this is done I am confident that you will have no difficulty in obtaining specific effects large enough to be visible before instrumental measurements.

Finally I must point out that these procedures are largely quite arbitrary. Many obvious shortcuts might give just as good or even better results. In particular, with regard to drying the gels, I believe that they may be removed from the beakers as soon as they are firm enough to be broken into discreet fragments and the grinding may be carried out as soon as the material is sufficiently brittle.

I anticipate that our new investigation of specific adsorption may turn up much useful information in the next two or three months and I will try to advise you of important developments. However, don't let our program deter you from starting your own work in this field. I feel that the potentialities of specific adsorption fully justify the attention of a large number of workers. I should be very interested to hear something about the applications to the study of adaptive enzymes which you contemplate.

Sincerely,

Frank H. Dickey